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SHORT COMMUNICATION

Quality assurance in biomedical engineering COOP-educational training program: Planning, implementation and analysis

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Abstract The paper sets selected definitions of terms which are important to apply for the interactions of all participants in a cooperative and educational training program COOP. It describes details how the COOP program is developed to closely match the National qualifications framework designed by the Saudi National Commission on Academic Accreditation and Assessment (NCAAA). Within this applied research results of the COOP program at King Saud University, an infrastructure is developed and applied on students registered for the associate degree program in the medical equipment technology. This covers time planning and skills to be acquired during the training and most important departments and medical devices that must be accessible to the student. Analysis, results and statistics are presented and discussed as well as ways of improvement.

1. Introduction

The cooperative education program (COOP) for the medical equipment technology education is to emphasize the knowledge of students and implementing it in a practical application to obtain real experience in a real work environment and realistic situations during their training in health care institutions, medical solutions companies and selected hospitals. The goal is to refine their talents and establish distinct links between the foundations and principles and practical skills in the field of medical equipment technology in terms of good management. It also optimizes the investment of medical equipment and maintenance, and familiarizes creative

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thinking and practice good work ethic, self-reliance, and cooperation with others. Supervisors and trainees play a critical role in promoting interactions among them in the learning process. Cooperative education program has proved to be an effective process that can promote this interaction to benefit all parties. When students interact in cooperative groups, they learn to give and receive information, develop new understandings and perspectives, and communicate in a socially acceptable manner. It is through interacting with each other in reciprocal dialogs to construct new ways of thinking and build their sense of feeling especially toward their future career (Barnes, 1969; Mercer, 1996). Cooperative learning creates opportunities for students to actively interact with others, negotiate meaning around a task, and appropriate new ways of thinking and working (King, 1999; Rogoff and Toma, 1997). By establishing a learning environment where students feel safe to test out their ideas, free from the scrutiny of the classroom teacher and the wider class group, they are provided with opportunities to reach out to each other and establish a personal synergy that facilitates engagement, promotion of learning, and group cohesion—all necessary elements for successful cooperative learning (Johnson and Johnson, 1990; Slavin, 1995). The present study builds on a practical implementation of the cooperative education program at the community college-applied medical sciences department in King Saud University (KSU) that indicates that when teachers are fully involved in the cooperative education program, how efficient the learning outcome of the trainee is affected as well as how supervisors change the way they interact with their students. This is to determine if teachers can also be trained to use specific communication skills and improved ways to motivate the transfer of their knowledge to the trainees to facilitate creative thinking and learning during the COOP program for better results. The paper demonstrates the results of the COOP program in real work environment. The cooperative education program at the applied medical sciences department (AMS) of King Saud University in Riyadh is the first to provide medical equipment technology students the opportunity to apply their academic knowledge and skills in a work-based environment under full control from the university in cooperation with the training institution. This should fully match the definition of the COOP program which states that the COOP program is the process of relating student's academic achievements with practical and authentic reality. This is achieved while the student trains at a hospital or health care companies which are carefully chosen by the academic institution. The COOP program in the department of applied medical sciences at King Saud University provides medical equipment technology students the opportunity to work in a training organization to complete the requirements of their associated degree program. The COOP is a 15 weeks, 12 credit hours program that students register for after completing 64 academic credit hours.

2. NCAAA framework

In its approach to support the planning, monitoring and improvement of field experience programs, The National Commission for Academic Accreditation and Assessment (NCAAA) has developed two key documents: the field experience specification and the annual field experience report.

The field experience specification file is completed during the planning and development phases of the COOP program. It includes the aims and objectives and a summary description of the intended learning outcomes of the field experience in each of the domains of learning. Second, a general description of the field experience activity is stated.

Third, the planning and preparation of the field experience is described. Fourth, the criteria for student assessment are described along with the responsibilities of the supervising faculty and staff. Finally, arrangements for the evaluation of the field experience activity by students, supervising staff in the field, and supervising staff from the institution are explained. The field experience report is completed at the end of each COOP program cycle (Handbook 2, Internal Quality Assurance Arrangements. The National Commission for Academic Accreditation and Assessment, March 2007).

2.1. COOP-terminology

Cooperative education is defined as a process of education that formally integrates a Student's academic and/or career interests with a productive work experience in a cooperating employer organization (National Commission for Cooperative Education at www.co-op.edu).

Training coordinator is a chosen employee from the department who is obligated to become an informative agent between the COOP program and the department at the university.

Academic supervisor is a professor who is chosen to continuously supervise students seeking cooperative education and to evaluate their performance through a previously designed plan which includes a weekly site visit.

Training supervisor is an employee at the institute where the student receives his training. The training supervisor is in charge of supervising the student.

3. Method

3.1. Planning and developing of COOP program

The program takes the student through practical training in various identified professional organizations. The organization could be a hospital or medical equipment company.

The planning and developing of the program includes:

1. A survey of the needs of the labor market in specialization and the ability of stockholders to accommodate students training and capacity to train students in accordance with the program.
2. Preparation of the trainees enough time before the start of training through lectures which familiarize them with their rights and obligations.
3. Holding meetings with training supervisors to make sure that they absorb the content of the COOP program and familiarize them with their duties and obligations.
4. Selection of the sections where students are trained and how long the students will spend time in each section, and making a tour in the training institution.

5. A weekly lecture is held by the academic supervisors for the trainees. This is to compensate and complete their knowledge about medical equipment they may not cover during the training.

3.2. Participants

The three different stockholders involved in making decisions about COOP program are employers (training institutions), administrative member (training coordinator) and students.

3.3. Program follow-up

The training coordinator together with the department's chairman explores the chances of training at different institutions through meetings and letters.

Thereafter the students are informed and distributed to their training places. A training plan is accurately set according to the needs of each specialization. This ensures that the trainee fills the practical gaps which are not to be fulfilled by the college as an academic institution. One of the duties of the training coordinator is to measure how strictly the proposed training program put by both the training institution and the college department is implemented through regular meetings and a follow-up form. After the students allocations are conducted by the academic supervisors the actual training starts. Fig. 1 represents the developed organization chart that is implemented at the applied medical sciences department at King Saud University. It shows the flow of information and feedback for the applied cooperative training program.

The academic supervisors pre-evaluate the learning efficiency of students through daily and weekly and monthly students' reports.

The training supervisor submits a monthly student assessment report to the academic supervisor to be reviewed in the department at the college for locating deviations or problems.

3.4. Student assessment

The assessment of student based on the following elements: the behavior, self-reliance, the ability to perform tasks, interest in work, general appearance, relationship with others. Also the student must submit a final report documenting what the student achieved within the weeks of training.

The grade distribution for the COOP is 20% from the training organization (or the training supervisor) and 60% from the academic supervisor and 20% from external committee evaluating the student's final report.

3.5. Evaluation and improvement

The academic supervisors act as a liasion between the training sites and AMS department. They are responsible for obtaining regular feedback and resolving any work related issues. On their weekly site visits, they also have discussions with work supervisors on their suggestions regarding the program. Areas of improvements are modification of evaluation form, searching new training institutions, increasing the number of academic supervisors, improvement of evaluation procedures and increasing the coordination with the training supervisors.

4. Results

Since the establishing of AMS department at KSU in June 2009 about 106 students were enrolled in the COOP program by more then 12 training institutions for 15 weeks at 40 h per week. The program included student work in four different workshops for the maintenance and troubleshooting of medical equipment for a period between 3 and 4 weeks within each workshop like medical imaging system workshop, electronic medical equipment workshop, mechanical medical equipment workshop, and medical laboratory instrumentation workshop.

The training at medical imaging system workshop includes preventive maintenance and maintenance of high voltage transformers, cables, X-ray tube and maintenance of mobile X-ray, Cath-Lab, and Ultrasound Scanner.

The training at electronic medical equipment workshop includes electronic skills development such as dealing with printed electrical circuit and electronic devices, also includes various training on the maintenance of ECG, EMG, EEG and defibrillator also includes training on preventive maintenance of all electronic medical equipment under the supervision of engineers with expertise in the field of biomedical engineering.

The training at mechanical medical equipment workshop includes training on maintenance of pumps, incubators, ventilators, injection pumps, infusion pumps, anesthesia machines, and sterilization equipment as well as preventive maintenance of all mechanical medical equipment. During the training period the number of lectures on some of the selected devices will be given. The training at Clinical Laboratory Instrumentation workshop includes training on preventive maintenance and maintenance of gas analyzer, blood counters, spectrophotometer, flame photometer, and microscope.

The percentage of students who pass the COOP program is 100% and the percentage of students who have obtained jobs after finishing the COOP program is 68%. It is worth mentioning that some of the trainees signed job contracts even before they have finished their training period.

5. Discussion

Results of trainees' evaluation reflected the suitability of the training program to the needs of the training institutions and

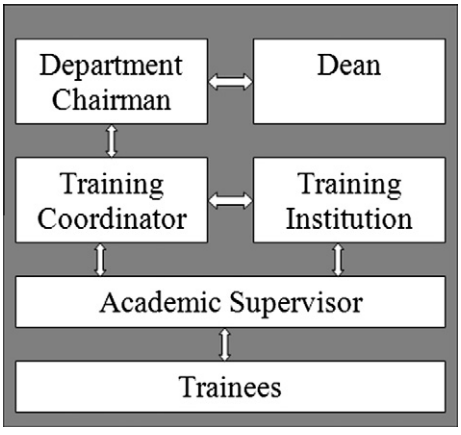

Figure 1 COOP-organization chart of the applied medical sciences department.

the ability to develop human resources in the medical equipment technology specialization. Questionnaires showed the need to intensify cooperation between the training institutions and AMS department. It also showed satisfaction with all points of training program specially the academic supervisor weekly site visit.

Questionnaires showed that the students received good information on specialization and practice what they learn on real work environment and follow up each new development in this area and develop their skills in the maintenance of medical equipment. It has also shown a desire to prolong the duration of the training and to continue education to obtain a higher degree of specialization.

A number of factors have contributed to the success of the COOP program in AMS. The effective communication between the employers and the COOP coordinator helps identify, resolve and prevent problems. The uniqueness of the AMS COOP program lies in the close and regular and continuous supervision of students throughout the training period. This is achieved through the academic supervisor weekly site visits and ongoing communication with field supervisors.

Of all students who passed the program, 68% obtained jobs, 5% are continuing study to achieve the bachelor degree, and 27% are still seeking for a job.

Students with moderate academic performance demonstrated exceptional work skills and were hired by their training organizations. COOP education also helps faculty who work as academic supervisors in keeping up to date with the rapidly changing medical technology field. Such real-world experiences allow a student to explore career options and better define his role in the biomedical engineering community.

6. Conclusion

This analysis and description of the COOP model at the applied medical sciences department can be conducted by other colleges and be a model for their training which is confined by three major entities: student, academic supervisor and training supervisor. The paper described the factors that contributed to the success of the COOP experience.

Results so far show that the program has proven to be successful in strengthening the relationship between employers and the higher education institutions to meet the local job market demands and enhances the ''saudiazation'' program conducted by the Saudi government.

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